PATENT ABSTRACTS OF JAPAN

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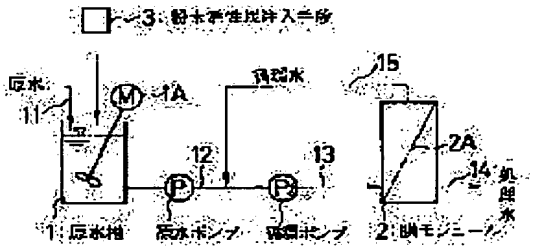
(72)Inventor : OTA YOSHIOKI
TAKADOI TADASHI

(54) WATER PURIFYING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To reduce a running cost, in a water purifying device performing a membrane separation treatment by adding powdery activated carbon to river water.
SOLUTION: Superfine powdery activated carbon having 0.01-10 μm particle sizes is added to raw water to perform a membrane separation treatment. The particle sizes of the powdery activated carbon can be made to superfine particles separatable with a membrane. When the powdery activated carbon becomes smaller particle sizes, the pore area becomes remarkably larger and the adosrption performance is enhanced in accordance with increase of the pore area. Thus, the necessary amounts to be added are sufficient in smaller amounts. By making the powdery activated carbon into a superfine shape, a cost of the powdery activated carbon becomes about 1.5 times of the conventional product. However when the superfine powdery activated carbon is used, since the necessary amounts of the powdery activated carbon to be added can be reduced, the cost of the powdery activated carbon is reduced.



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CLAIMS

[Claim(s)]
[Claim 1] raw water -- a means with a particle diameter of 0.01-10 micrometers overly to add microparticulate powdered activated carbon -- this -- the water purification processor which comes to have the membrane-separation means which carries out membrane-separation processing of the water with which microparticulate powdered activated carbon was overly added.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a water purification processor, especially, purifies river water efficiently and relates to the water purification processor which obtains water purification of the quality of a flood.
[0002]
[Description of the Prior Art] There is a thing using a membrane-separation means as a water purification technique of purifying the river water containing an odor and taste, a chromaticity, a trihalomethane precursor, and other organic substances etc. conventionally, and obtaining water purification, and after adding powdered activated carbon to the raw water of membrane separation, the approach of carrying out membrane-separation processing is enforced.
[0003] The powdered activated carbon used in such water purification processing is the thing of a coarse particle size which can fully carry out separation clearance in general coagulation sedimentation and filtration processing, and is usually a thing with a mean particle diameter of about 18 micrometers.
[0004]
[Problem(s) to be Solved by the Invention] Although the treated water progression in quality could be planned by the absorption of powdered activated carbon by adding powdered activated carbon to the raw water of membrane-separation processing, in the conventional method, generally there were comparatively many need additions of the powdered activated carbon for clarification as 20 - 50 mg/l, and the cost of powdered activated carbon cost dearly and, thereby, had caused the large jump of a running cost.
[0005] This invention solves the above-mentioned conventional trouble, and it aims at offering the water purification processor which enables sharp reduction of a running cost in the water purification technique which adds powdered activated carbon and carries out membrane-separation processing.
[0006]
[Means for Solving the Problem] the water purification processor of this invention -- raw water -- a means with a particle diameter of 0.01-10 micrometers overly to add microparticulate powdered activated carbon -- this -- it is characterized by coming to have the membrane-separation means which carries out membrane-separation processing of the water with which microparticulate powdered activated carbon was overly added.
[0007] When you adopt a membrane-separation means as a solid-liquid-separation means of the water which added powdered activated carbon, let the particle diameter of powdered activated carbon be a disengageable ultrafine particle of 2 to 3 times or more of membranous pore size. the case where the precision filtration (MF) film of 0.1 micrometers of pore size is used as a demarcation membrane -- the minimum particle diameter of 0.3 micrometers -- microparticulate powdered activated carbon is overly used. moreover, the case where the ultrafiltration (UF) film of 0.005 micrometers of pore size is used as a demarcation membrane -- the minimum particle diameter of 0.015 micrometers -- microparticulate powdered activated carbon is overly used.
[0008] Moreover, if particle diameter becomes small, that pore area will become big by leaps and bounds, and the adsorption engine performance of powdered activated carbon will also improve with buildup of this pore area.
[0009]
[Embodiment of the Invention] Hereafter, this invention is explained to a detail with reference to a drawing.
[0010] Drawing 1 and 2 are the schematic diagrams showing one example of the water purification processor of this invention.

[0011] The water purification processor shown in drawing 1 is a pump application-of-pressure method about the water in the raw water tub 1, and lets water flow and carries out cross flow filtration to the membrane module 2 which contained hollow fiber 2A to casing. In drawing 1 , by overly adding microparticulate powdered activated carbon from the powdered-activated-carbon impregnation means 3, and agitating raw water, such as river water introduced into the raw water tub 1 from piping 11, by agitator 1A, adsorption treatment is carried out and an odor and taste, a chromaticity, and an organic substance are removed. The water of the raw water tub 1 is a raw water conveying pump P1. Piping 12 and the circulating pump P2 which it has Through the piping 13 which it has, it is introduced into a membrane module 2 and membrane-separation processing is carried out. The pure permeated water with which powdered activated carbon was separated by hollow fiber 2A of a membrane module 2 is taken out from piping 14 as treated water, and it circulates through retentate from piping 15 as circulating water.
[0012] It is a circulating pump P2 instead of adding powdered activated carbon to the raw water tub 1 in this water purification processor. You may add by the outlet side.
[0013] In addition, the powdered-activated-carbon impregnation means itself can adopt the same thing as usual.
[0014] The water purification processor shown in drawing 2 is immersion membrane filtration equipment with which at least water used together the difference utilization method and the pump attraction method, it is immersed in the film immersion tub 4 in the membrane module 5, and the powder trachea 6 is formed under this membrane module 5. Difference W is formed in the water surface of this film immersion tub 4, and the water surface of the treated water tub 7 where the permeated water of a membrane module 5 is introduced at least for water.
[0015] In the water purification processor of this drawing 2 , as for the raw water introduced into the film immersion tub 4 from piping 11, microparticulate powdered activated carbon is overly added from the powdered-activated-carbon impregnation means 3. And suction pump P3 after adsorption treatment was agitated and carried out by the aeration by the powder trachea 6 and the odor and taste, the chromaticity, and the organic substance were removed And at least said water penetrates a membrane module 5 with Difference W, and the pure water with which powdered activated carbon was separated is introduced into the treated water tub 7 from piping 16.
[0016] In this invention, if the minimum particle diameter of microparticulate powdered activated carbon overly exceeds 10 micrometers, since a big improvement effect will not be acquired by the adsorption engine performance as compared with the powdered activated carbon generally used conventionally, the reduction effectiveness of a running cost will also become small. the particle diameter of less than 0.01 micrometers -- microparticulate powdered activated carbon is difficult to manufacture, and it is not overly practical.
[0017] By overly using microparticulate powdered activated carbon, to the need addition of the powdered activated carbon in the conventional water purification processing having been 20 - 50 mg/l, the adsorption treatment of an odor and taste, a chromaticity, the organic substance, etc. can be efficiently carried out in the addition of 3 - 10 mg/l extent, and the cutback of activated carbon cost can be aimed at by sharp reduction of an addition with the remarkably excellent adsorption engine performance.
[0018] In addition, or microparticulate powdered activated carbon ultrafine-particle-izes with a grinder the usual powdered activated carbon which overly selects microparticulate powdered activated carbon carefully so that it may become the suitable particle size distribution used by this invention, it can overly be easily manufactured by considering as activated carbon using the carbon of an ultrafine particle etc.
[0019]
[Example] An example and the example of a comparison are given to below, and this invention is more concretely explained to it.
[0020] The water purification processor shown in an example 1 and 2 drawing 1 purified river water (TOC5.0 mg/l).
[0021] Powdered activated carbon was added with the mean particle diameter and the addition which are shown in a table 1. As a demarcation membrane of a membrane module, UF film of polysulfone, 13,000dalton, and an internal pressure hollow filament was used.
[0022] TOC of the obtained treated water is shown in a table 1.
[0023] Except having used the thing of the mean particle diameter shown in a table 1 as example of comparison 1 powdered activated carbon, it carried out like the example 1 and TOC of the obtained treated water was shown in a table 1.
[0024] In the example 1 of example of comparison 2 comparison, the addition of powdered activated carbon

was increased, the powdered-activated-carbon addition required in order to obtain treated water equivalent to the treated water in an example 1 was investigated, and the result was shown in a table 1.
[0025] In addition, in examples 1 and 2 and the examples 1 and 2 of a comparison, relative cost was computed by having set powdered-activated-carbon cost (price x addition of the powdered activated carbon per unit weight) for obtaining the water purification of a constant rate in the case of the example 2 of a comparison to 100, and the result was shown in a table 1.
[0026]
[A table 1]

例		粉末活性炭平均粒子径 (μm)	粉末活性炭添加量 (mg/ℓ)	処理水TOC (mg/ℓ)	粉末活性炭コスト(%)
実施例	1	0.4	30	2.5～2.7	23
	2	1.5	100	2.6～2.8	75
比較例	1	18	30	4.5～4.7	15
	2	18	200	2.7～2.9	100

[0027] According to this invention, a table 1 shows that the running cost of a water purification processor can be reduced substantially.
[0028]
[Effect of the Invention] According to the water purification processor of this invention, water purification processing cost can be fallen substantially and it is very advantageous industrially as explained in full detail above.

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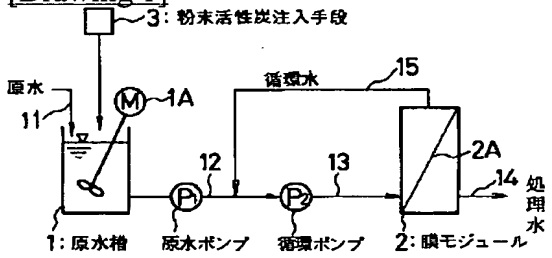
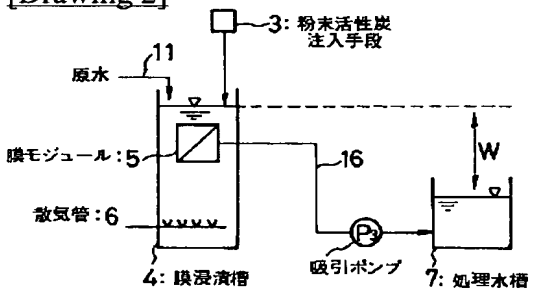
DRAWINGS

[Drawing 1]



[Drawing 2]



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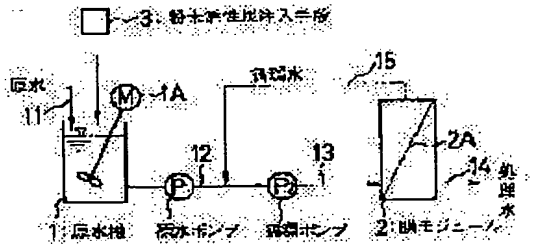

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審査請求　未請求　請求項の数１　ＯＬ　（全 ３ 頁）

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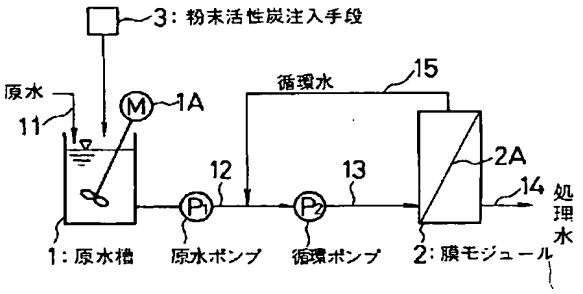
(54)【発明の名称】　浄水処理装置

(57)【要約】

【課題】　河川水に粉末活性炭を添加して膜分離処理する浄水処理装置において、ランニングコストの低減を図る。

【解決手段】　原水に粒子径０．０１～１０μｍの超微粒状粉末活性炭を添加して膜分離処理する。

【効果】　粉末活性炭の粒子径は膜で分離可能な超微粒子とすることができる。粉末活性炭は、粒子径が小さくなると、その細孔面積が飛躍的に大きなものとなり、この細孔面積の増大に伴って吸着性能も向上する。このため必要添加量が少なくて足りる。粉末活性炭を超微粒状とすることにより、粉末活性炭コストは、従来の１．５倍程度となるが、超微粒状粉末活性炭であれば、粉末活性炭の必要添加量が低減することで粉末活性炭のコストを低減することができる。



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【特許請求の範囲】

【請求項１】　原水に粒子径０．０１～１０μｍの超微粒状粉末活性炭を添加する手段と、該超微粒状粉末活性炭が添加された水を膜分離処理する膜分離手段とを備えてなる浄水処理装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は浄水処理装置に係り、特に、河川水を効率的に浄化して、高水質の浄水を得る浄水処理装置に関する。

【０００２】

【従来の技術】従来、異臭味、色度、トリハロメタン前駆物質、その他の有機物質を含有する河川水等を浄化して浄水を得る浄水技術として、膜分離手段を利用するものがあり、膜分離の原水に粉末活性炭を添加した後膜分離処理する方法が実施されている。

【０００３】このような浄水処理において用いられる粉末活性炭は、一般の凝集沈殿及び濾過処理で十分に分離除去できるような粗い粒径のものであり、通常、例えば平均粒子径１８μｍ程度のものである。

【０００４】

【発明が解決しようとする課題】膜分離処理の原水に粉末活性炭を添加することにより、粉末活性炭の吸着作用で処理水質の向上を図ることができるが、従来法では、浄化のための粉末活性炭の必要添加量が一般に２０～５０ｍｇ／ｌと比較的多く、粉末活性炭のコストが高くつき、これにより、ランニングコストの大幅な高騰を招いていた。

【０００５】本発明は上記従来の問題点を解決し、粉末活性炭を添加して膜分離処理する浄水技術において、ランニングコストの大幅な低減を可能とする浄水処理装置を提供することを目的とする。

【０００６】

【課題を解決するための手段】本発明の浄水処理装置は、原水に粒子径０．０１～１０μｍの超微粒状粉末活性炭を添加する手段と、該超微粒状粉末活性炭が添加された水を膜分離処理する膜分離手段とを備えてなることを特徴とする。

【０００７】粉末活性炭を添加した水の固液分離手段として膜分離手段を採用する場合、粉末活性炭の粒子径は膜の細孔径の２～３倍以上の分離可能な超微粒子とする。例えば、分離膜として細孔径０．１μｍの精密濾過（ＭＦ）膜を用いる場合には、最小粒子径０．３μｍの超微粒状粉末活性炭を用いる。また、分離膜として細孔径０．００５μｍの限外濾過（ＵＦ）膜を用いる場合、最小粒子径０．０１５μｍの超微粒状粉末活性炭を用いる。

【０００８】また、粉末活性炭は、粒子径が小さくなると、その細孔面積が飛躍的に大きなものとなり、この細孔面積の増大に伴って吸着性能も向上する。

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【０００９】

【発明の実施の形態】以下、図面を参照して本発明を詳細に説明する。

【００１０】図１，２は本発明の浄水処理装置の一実施例を示す系統図である。

【００１１】図１に示す浄水処理装置は、原水槽１内の水を、ポンプ加圧方式で、中空糸膜２Ａをケーシングに収納した膜モジュール２に通水してクロスフロー濾過するものである。図１において、配管１１より原水槽１に導入された河川水等の原水は、粉末活性炭注入手段３より超微粒状粉末活性炭が添加され、撹拌機１Ａで撹拌されることにより吸着処理され、異臭味、色度、有機物質が除去される。原水槽１の水は、原水ポンプP_1を備える配管１２及び循環ポンプP_2を備える配管１３を経て膜モジュール２に導入され、膜分離処理される。膜モジュール２の中空糸膜２Ａで粉末活性炭が分離された清浄な透過水は、配管１４より処理水として取り出され、濃縮水は循環水として、配管１５より循環される。

【００１２】この浄水処理装置において、粉末活性炭は原水槽１に添加する代りに、循環ポンプP_2の出口側で添加しても良い。

【００１３】なお、粉末活性炭注入手段自体は、従来と同様のものを採用することができる。

【００１４】図２に示す浄水処理装置は、水位差利用方式とポンプ吸引方式とを併用した浸漬膜濾過装置であり、膜浸漬槽４には膜モジュール５が浸漬されており、この膜モジュール５の下方には散気管６が設けられている。この膜浸漬槽４の水面と、膜モジュール５の透過水が導入される処理水槽７の水面とには、水位差Ｗが形成されている。

【００１５】この図２の浄水処理装置において、配管１１より膜浸漬槽４に導入された原水は、粉末活性炭注入手段３より超微粒状粉末活性炭が添加される。そして、散気管６による曝気で撹拌されて吸着処理され、異臭味、色度、有機物質が除去された後、吸引ポンプP_3及び前記水位差Ｗで膜モジュール５を透過し、粉末活性炭が分離された清浄な水が配管１６より処理水槽７に導入される。

【００１６】本発明において、超微粒状粉末活性炭の最小粒子径が１０μｍを超えると、従来一般に用いられている粉末活性炭に比較して吸着性能に大きな改善効果が得られないことから、ランニングコストの低減効果も小さいものとなる。粒子径０．０１μｍ未満の超微粒状粉末活性炭は、製造が困難で、実用的ではない。

【００１７】超微粒状粉末活性炭を用いることにより、その著しく優れた吸着性能により、従来の浄水処理における粉末活性炭の必要添加量が２０～５０ｍｇ／ｌであったのに対し、３～１０ｍｇ／ｌ程度の添加量で異臭味、色度、有機物質等を効率的に吸着除去でき、添加量の大幅な低減で、活性炭コストの削減を図ることができ

る。

【００１８】なお、本発明で用いる超微粒状粉末活性炭は、適当な粒度分布となるように超微粒状粉末活性炭を精選する、通常の粉末活性炭を粉砕機で超微粒子化する、或いは、超微粒子の炭素を用いて活性炭とするなどの方法により容易に製造することができる。

【００１９】

【実施例】以下に実施例及び比較例を挙げて本発明をより具体的に説明する。

【００２０】実施例１，２

図１に示す浄水処理装置により、河川水（ＴＯＣ５．０ｍｇ／ｌ）の浄化を行った。

【００２１】粉末活性炭は、表１に示す平均粒子径及び添加量で添加した。膜モジュールの分離膜としては、ポリスルホン、１３，０００ダルトン、内圧中空糸のＵＦ膜を用いた。

＊【００２２】得られた処理水のＴＯＣを表１に示す。

【００２３】比較例１

粉末活性炭として表１に示す平均粒子径のものを用いたこと以外は実施例１と同様に行って、得られた処理水のＴＯＣを表１に示した。

【００２４】比較例２

比較例１において、粉末活性炭の添加量を増加して、実施例１における処理水と同等の処理水を得るために必要な粉末活性炭添加量を調べ、結果を表１に示した。

【００２５】なお、実施例１，２及び比較例１，２において、比較例２の場合の、一定量の浄水を得るための粉末活性炭コスト（単位重量当りの粉末活性炭の価格×添加量）を１００として、相対的なコストを算出し、結果を表１に示した。

【００２６】

＊【表１】

例		粉末活性炭平均粒子径（μｍ）	粉末活性炭添加量（ｍｇ／ｌ）	処理水ＴＯＣ（ｍｇ／ｌ）	粉末活性炭コスト(%)
実施例	1	０．４	３０	２．５～２．７	２３
	2	１．５	１００	２．６～２．８	７５
比較例	1	１８	３０	４．５～４．７	１５
	2	１８	２００	２．７～２．９	１００

【００２７】表１より、本発明によれば、浄水処理装置のランニングコストを大幅に低減することができることがわかる。

【００２８】

【発明の効果】以上詳述した通り、本発明の浄水処理装置によれば、浄水処理コストを大幅に低下することができ、工業的に極めて有利である。

【図面の簡単な説明】

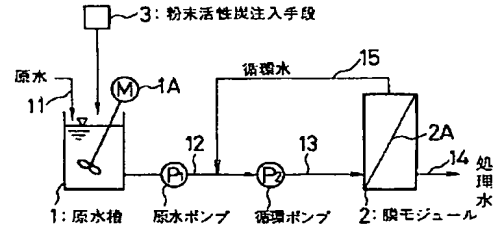
【図１】本発明の浄水処理装置の一実施例を示す系統図である。

※【図２】本発明の浄水処理装置の他の実施例を示す系統図である。

【符号の説明】

１　原水槽
２，５　膜モジュール
３　粉末活性炭注入手段
４　膜浸漬槽
６　散気管
７　処理水槽

【図１】



【図２】